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ABSTRACT

This Kamehameha Early Education Program (KEEP) report describes two studies on the effects of student-teacher interaction on student performance. Study I explored the relationship between three kinds of teacher behaviors (modeling, teacher attention to individual students, and praise-giving to individual students) and the pupil's academic achievement. The daily achievement of nine kindergarten children in the upper third of their class was recorded. Videotapes of 16 lessons (15 to 30 minutes each) on the use of cuisenaire rods for mathematical development were analysed. Results indicated that neither the teacher's modeling behavior nor the amount of praise and amount of individual attention awarded by her was related to the children's academic achievement. Study II investigated the effect of two methods of teacher input on student performance: working with one small group for a 5-minute period while the other children worked independently (condition A) and moving from table to table giving individual assistance as needed (condition B). The subjects, 28 kindergarten children, were divided into five heterogeneous groups. One group of six students was assigned to condition A and the rest to condition B. Differences in achievement between condition A and B were not statistically significant, although there were more statements of academic input to students under condition B than under condition A. (CM)

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The Kamehameha Early Education Program

The Kamehameha Early Education Program (KEEP) is a research and development program of The Kamehameha Schools/Bernice P. Bishop Estate. The mission of KEEP is the development, demonstration, and dissemination of methods for improving the education of Hawaiian and Part-Hawaiian children. These activities are conducted at the Ka Na'i Pono Research and Demonstration School, and in public classrooms in cooperation with the State Department of Education. KEEP projects and activities involve many aspects of the educational process, including teacher training, curriculum development, and child motivation, language, and cognition. More detailed descriptions of KEEP's history and operations are presented in Technical Reports #1-4.

Abstract

The two studies presented here are representative samples of projects which grew out of the Educational Specialist research-training seminars.

It has been one goal of Educational Specialist training to enable these teacher-consultants to use empirical methods in assessing the educational practices of themselves and others. While neither of these studies report strong effects, both are impressive examples of beginning research, and demonstrate that teachers can effectively use research methods in refining classroom operations.

The Editors

Sample Project A

Relationships Between Selected Teacher Behaviors and Pupil Academic Achievement: Preliminary Observations

Kathryn H. Au

The information presented in this study was gathered from a set of lessons I taught as part of a training program involving videotape analysis of my teaching. It was my purpose in these lessons to explore ways in which systematic observations would yield relevant teacher-pupil interactions. Specifically, 1) modeling, and 2) praise and attention statements directed to individual students were examined in terms of their relationship to pupils' academic achievement. This focus on academic achievement is in contrast to the application of behavior analysis to problems of classroom management.

Method

Subjects

Nine kindergarten children, in the upper third of their class, were selected from the KEEP Class 1. The group was of mixed socio-economic background, six children being from middle-class families, and three from families receiving financial assistance from the State. The students were seated at tables in a semicircle around the table.

Teacher Behaviors

Three specific teacher behaviors were investigated: (1) modeling, (2) teacher attention to individual students, and (3) praise to individual

students. The effects of each of these behaviors will be discussed in turn under two headings: Modeling, and Teacher Praise and Attention.

Pupil Achievement

Pupil achievement was measured on a daily basis. One achievement objective was required each day. If the child met the objective, he received a score of 1; if he did not, he received a score of 0. Although a student was measured only on a single predetermined objective each day, further objectives were frequently introduced. The objectives were of graded difficulty, beginning with an exploration of the rods, to addition problems, in which one addend and the sum was stated, and the child had to find the missing addend. A student's success or failure on a particular day cannot, therefore, be related solely to the events of that day.

Procedure

Videotapes of sixteen lessons on the use of cuisenaire rods for mathematical development were analyzed. The lessons were from 15 to 30 minutes in duration.

I. The Effects of Modeling on Academic Achievement

Little is known at present about exactly what a teacher can do to help her students learn. However, one frequently used teaching technique is modeling, where the teacher demonstrates, or has a student demonstrate, step-by-step, what is required to complete a particular assignment. This method may be contrasted with that of giving directions verbally without acting out the various steps. Thus, the first hypothesis I attempted to test was whether more teacher modeling leads to more students accomplishing the day's objective.

Observation and Recording of Instances of Modeling

Modeling was defined as follows: showing the children what to do, or what was expected of them by gestures or manipulation of instructional materials, usually accompanied by a running verbal commentary. Modeling for an indivíual child, with materials in front of the teacher or with the child's own materials, was coded as teacher-attention.

Thirty-second time intervals were used; any occurrence of modeling during an interval was recorded. Reliability on the modeling category was established at 83.3 percent.

Results

The amount of modeling done by the teacher during each lesson was calculated as the number of intervals in which modeling occurred/total number of intervals. The amount of modeling showed a gradual drop over the 16-lesson period (see Figure 1). However, an examination of pupil achievement by days (Figure 2) and by weeks (Figure 3), showed that the decrease in modeling was not related to a decrease in the children's level of performance.

Discussion

The amount of modeling by the teacher gradually decreased over the period of the 16 lessons without a parallel decrease in the children's level of achievement. This is a highly desirable trend from a teaching standpoint, and may indicate that the children became more able to learn from verbal instructions. For young children, a great deal of modeling may be useful when a new set of activities is first introduced. Later, as the children acquire needed skills, the amount of modeling may be decreased and more verbal instruction substituted.

To test the effect of modeling in a more systematic way, an experiment could be set up using two groups of children--one group being taught with a

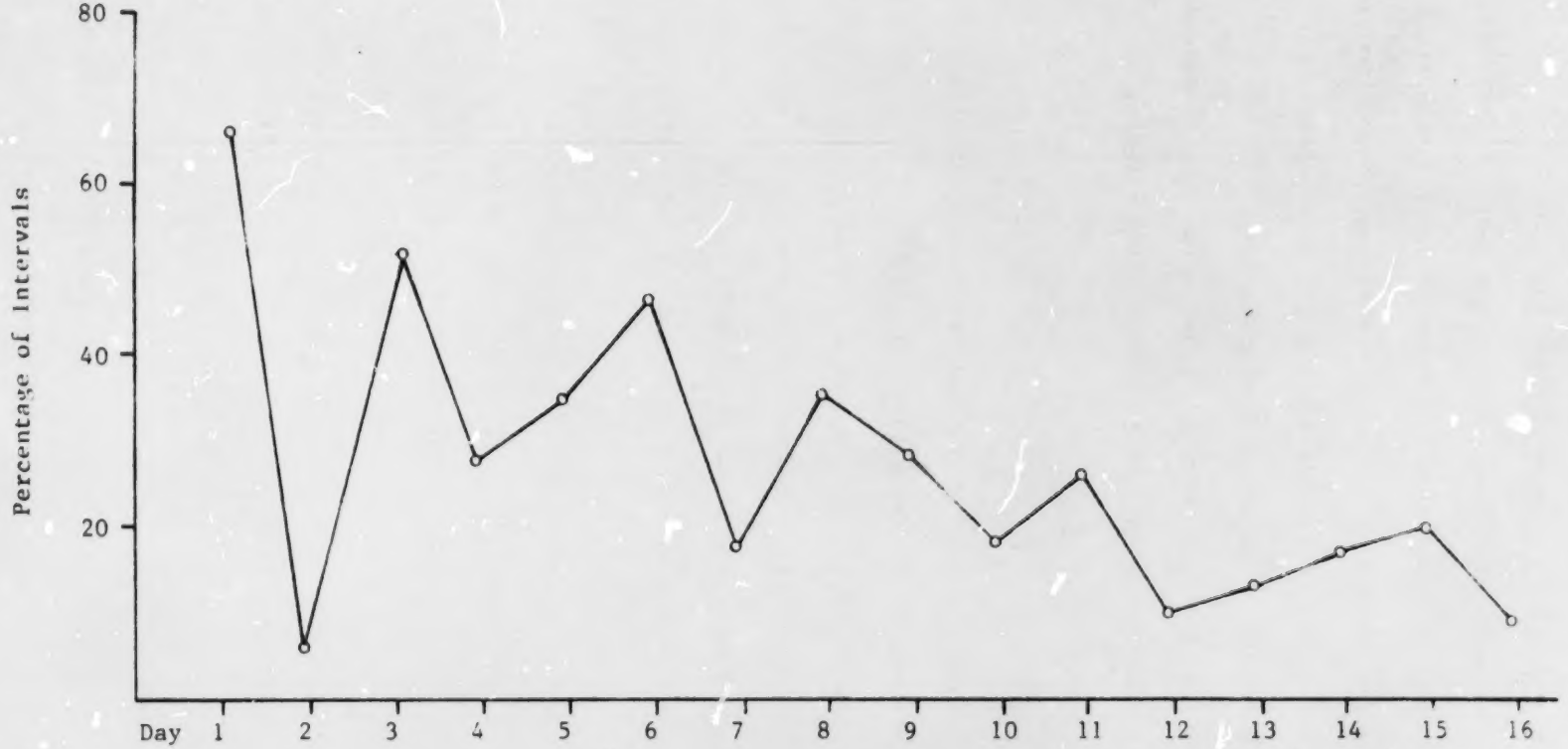

Figure 1

The Percentage of Intervals of Teacher Modeling over 16-Lesson Periods

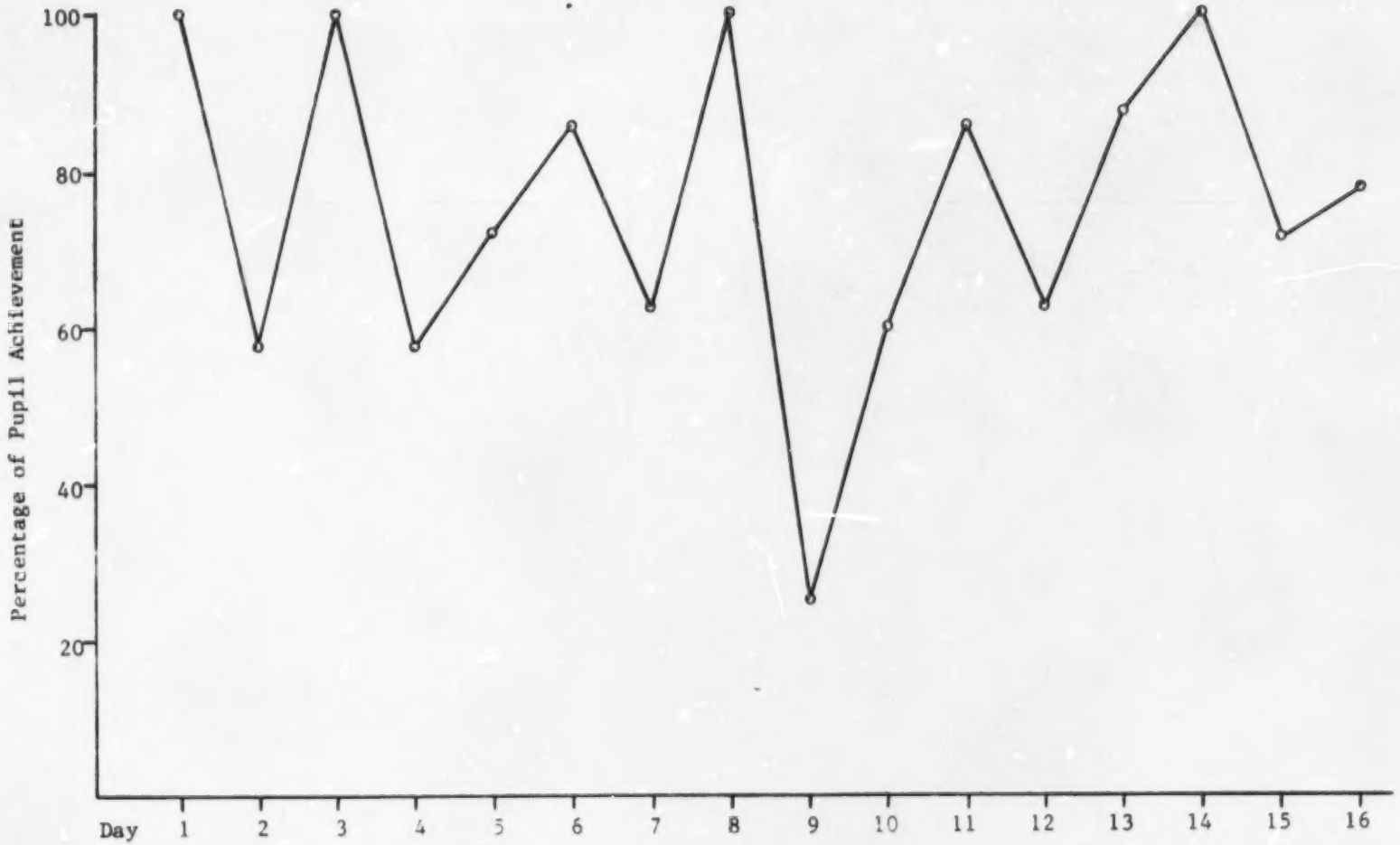

Figure 2

The Percentage of Pupil Achievement of Daily Objectives by Days

35-5

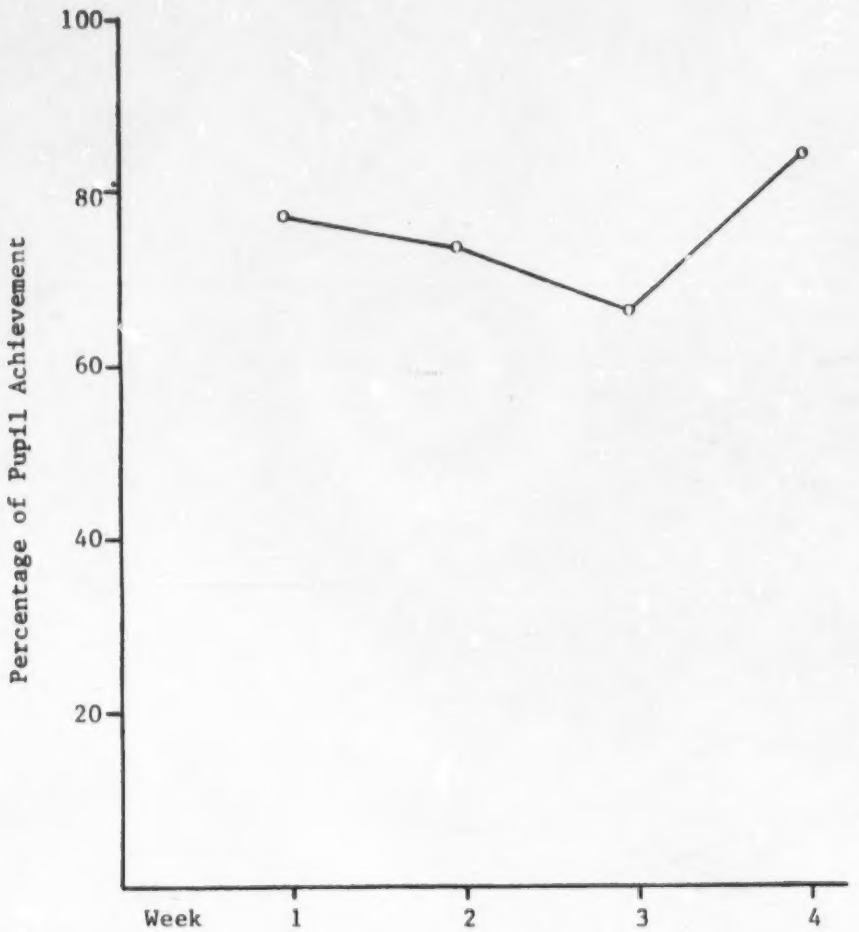

Figure 3

The Percentage of Pupil Achievement

of Daily Objectives by Weeks

great deal of teacher modeling, especially at the beginning, and one group being taught with little or none. If both groups were to pursue the same series of objectives, achievement under the two conditions could then be compared.

II. Effects of Teacher Attention and Praise on Student Achievement

The second focus in observing my videotaped lessons during self-examination was whether the amount of individual attention and individual praise given was related to achievement of the same daily objective as

described above (if more individual praise and attention resulted in better achievement, it would have implications for increasing those teaching behaviors). A further implication would be in regard to the size of the class. A teacher is able to give a much higher rate of individual attention and praise in a small group, in a regular-sized class. But, if there was no relationship between greater teacher attention and achievement, it would seem that most teacher time could just as well be devoted to large-group teaching.

Categories of Teacher Behavior: Praise and Attention

Praise of an individual child (Pi)

This category included such terms as, "good," "nice," well done," and other laudatory comments given by the teacher. "Right" would only be scored if it was stated enthusiatically. Comments setting up a child's behavior as a model to the others, such as "Terri has been working so nicely" would be scored Pi. Not included in Pi's were "O.K.," or descriptive comments like "Rosie is stacking her rods."

Attention to an individual child (Ai)

This category included verbal exchanges between the teacher and an individual child, instructions to a single child, and comments on a child's behavior, such as "Ronnie is working on his problems."

Method of Scoring

A simple frequency count was taken of the number of times that the teacher praised or gave attention to each individual student. For praise, reliability was established at 89.6 percent, and for attention, at 82.7 percent. A tally for Ai or Pi was made for each unbroken interaction. If the teacher talked to child 1, then addressed a remark to child 2, then returned to child 1, there would be two tallies for child 1. The same rule applied if the interaction was broken by the teacher's giving instructions. Both Ai and Pi could be scored for the same set of remarks.

For example, "Dinah, that was very quick work. (Pi). Now, would you read your answer to me." (Ai). The same applied to, "Good, (Pi) now read your answer to us." (Ai).

Results

Amounts of teacher praise and attention were calculated by taking the total number of individual praise and attention comments made by the teacher in one lesson, divided by the number of intervals in that lesson. Results are shown in the graphs by days (Figure 4) and by weeks (Figure 5). The amount of praise given by the teacher remained relatively constant over weeks, while the amount of attention showed a downward trend after the second week.

Overall, amount of praise and amount of individual attention was unrelated to achievement, as measured by the number of children who passed objectives each day. For the purpose of examining differences between High and Low achievers, individual children were ranked for achievement according to the number of days that they achieved the objective, divided by the number of days that they were present. Results are shown in Table 1.

Table 1

Individual Achievement Ranking

Student Number	Percent Days Achieved Objective
1	100.00
2	100.00
3	91.70
4	91.70
5	81.20
6	62.50
7	57.10
8	50.00
9	45.40

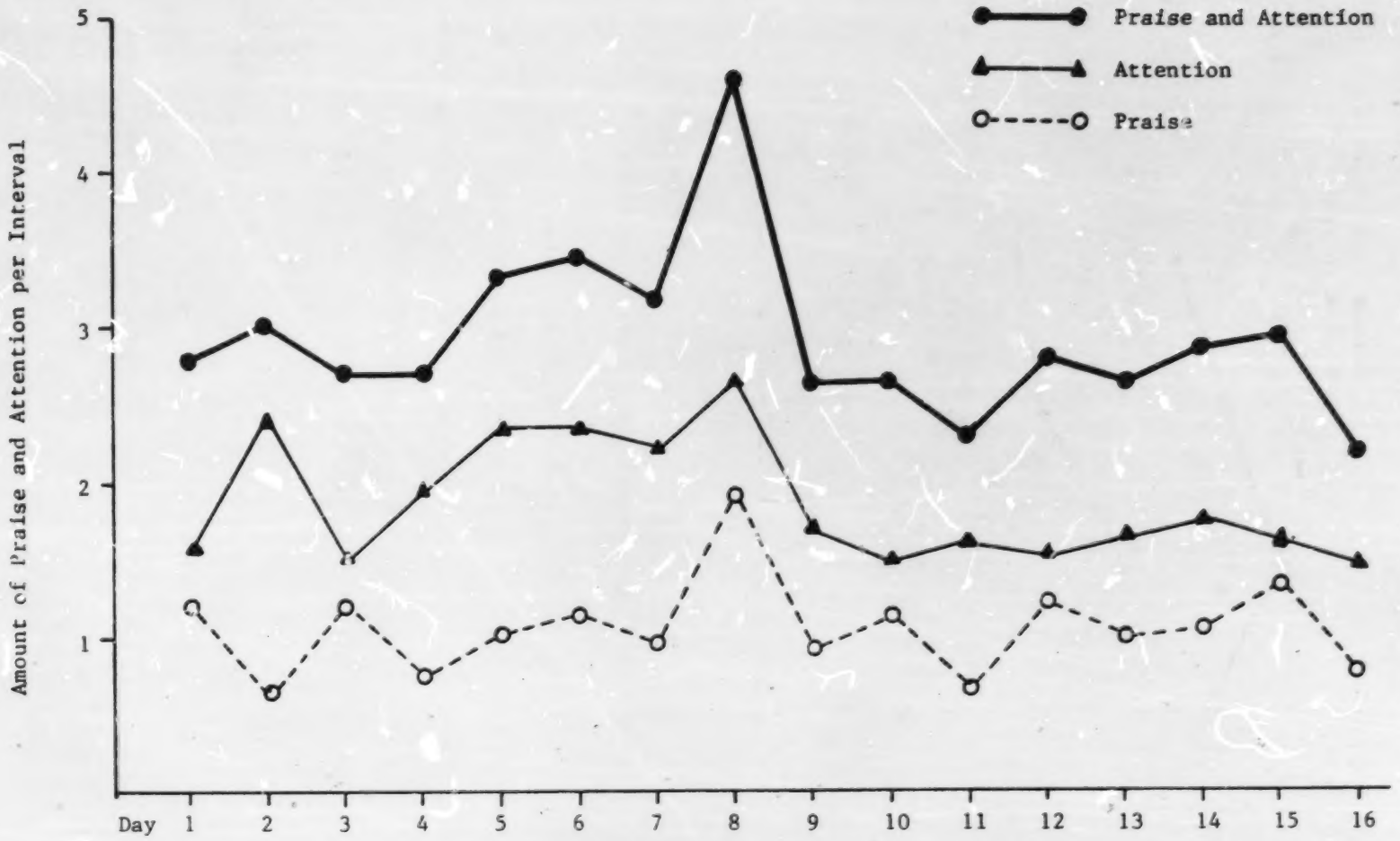

Figure 4

Amount of Praise and Attention per Interval by Days

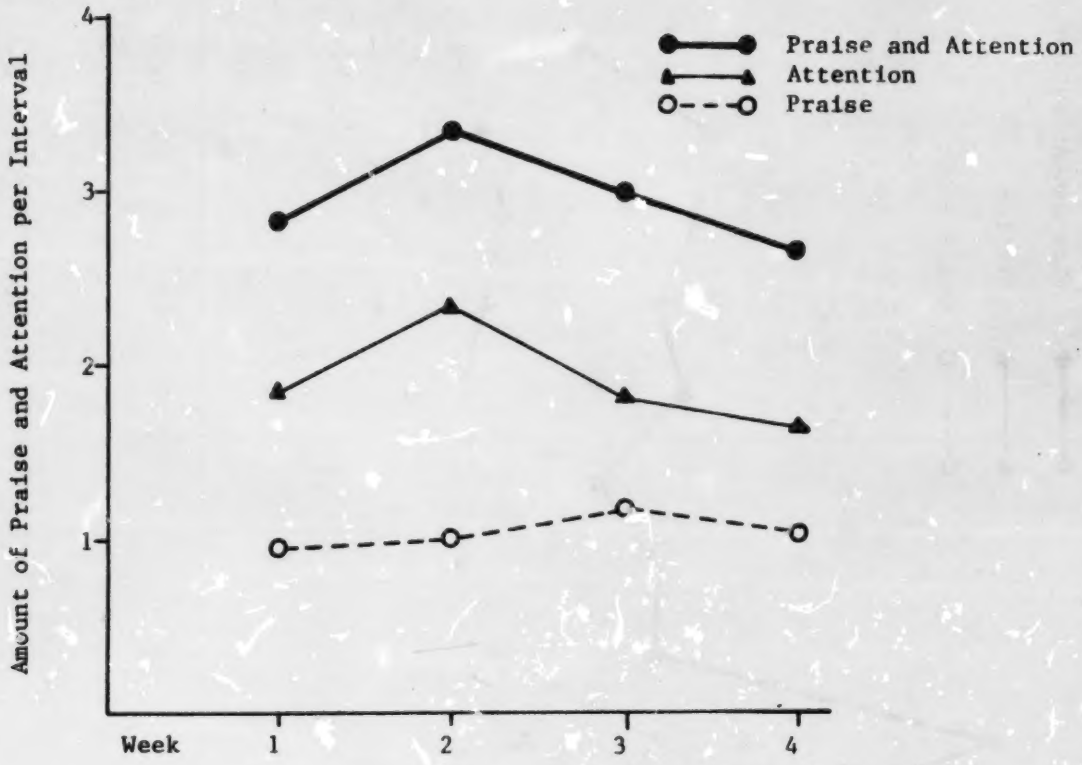

Figure 5

Amount of Praise and Attention per Interval by Weeks

Further analyses were then conducted with the top three students (High achievers) and the bottom three students (Low achievers).

High and Low days of praise or attention were obtained by the following method. The individual praise statements or attention behaviors by the teacher were summed over all sessions and over all children. This was divided by the sum of all the lessons that each child attended multiplied by the total number of minutes of instruction during the fifteen sessions. The resulting figure represented an overall average of the number of praises or attentions given per child per minute. All days on which this average number was higher were categorized as High Days, and all days on which the average was lower were categorized as Low Days.

Each child would receive on the average praise once in every 3.56 minutes (overall average number of praises per child per minute=.279). For both High and Low achievers, there was no significant relationship between high praise and success and low praise and failure to achieve the day's objective (see Table 2).

Table 2

Praise and Achievement

High Achievers

	A	NA
High Praise	15	0
Low Praise	23	1

X^2=.641

Low Achievers

	A	NA
High Praise	13	12
Low Praise	7	7

X^2=.014

A = Achieved the day's objective
NA = did not achieve the day's objective

There was no significant relationship between high teacher attention and success, or low teacher attention and failure, for the High achievers. However, for the Low achievers, a relationship, although not significant, was found (see Table 3).

Table 4 shows the results when teacher praise and attention are considered together. For Low achievers, a significant relationship exists between high praise and attention conditions and success, and low praise and attention and failure, but the same relationship does not occur with High achievers.

Discussion

As mentioned earlier, the achievement of the children on any given

Table 3

Attention and Achievement

High Achievers

	A	NA
High Attention	12	0
Low Attention	26	1

$X^2 = .456$

Low Achievers

	A	NA
High Attention	13	7
Low Attention	7	12

$X^2 = 3.092$
$p < .10$

Table 4

Praise and Attention and Achievement

High Achievers

	A	NA
High Praise and Attention	14	1
Low Praise and Attention	24	0

$X^2 = 1.642$
$p = .20$

Low Achievers

	A	NA
High Praise and Attention	14	6
Low Praise and Attention	6	13

$X^2 = 5.757$
$p < .02$

day cannot be related to that day's events only. Thus, it is not surprising to find that there is no clear relationship between amounts of teacher praise and attention, and total group achievement in these lessons.

A point to be taken into consideration is the overall rate of praising students, which in this case was quite high. Since the children were normally given a great deal of praise, it may be that within the apparently high range recorded in these lessons, slight variations in the amount of praise given did not make much difference to the students. That is, teacher

praise may have a bearing on academic achievement, but variations in the amounts of praise, in this case, were probably not large enough to have noticeable effects.

With the coding of attention, even more questions arise. Teacher statements coded as attention were numerous and included different behaviors. One subcategory already mentioned was that of modeling for individual children. Asking questions directed to individual children was another, prompting or cueing individuals still another. The question of appropriate timing can be raised. Providing additional individual instruction to a child can be appropriate or inappropriate, depending on whether or not the child really needs the extra help or not.

The present findings suggest that the performance of High achievers is not sensitive to different amounts of attention within the variation observed in these sessions. The academic behaviors of the High achievers were apparently maintained by an intermittent schedule of teacher reinforcement. These students continued at a high level of achievement even on days when they were relatively neglected, as compared to the average amount of attention given to the class as a whole. On the other hand, the Low achievers do seem to be more successful on days when they receive relatively high amounts of attention. This trend becomes significant for the Low achievers when praise and attention are considered conjointly. On days in which the Low achievers receive a relatively high amount of attention and/or praise, they succeed on the objectives significantly more than on low days of attention/praise.

How can a teacher get the most information across to the greatest number of children, in the shortest amount of time? This study suggests that much instruction of High achievers can be done in large groups. However,

for Low achievers, certain kinds of large group instruction, in which they receive little individual attention, may be wasted in terms of academic achievement. This idea is consistent with the practice in many school settings of grouping students by ability level, with the low ability groups being much smaller than the high ability groups.

Sample Project B

The Effect of Teacher Input on Student Performance

Kathryn H. Au

The use of learning centers is basic to many elementary education programs. At the Kamehameha Early Education Project (KEEP) during the school year 1972-73, learning centers formed the core of the academic program, providing the format in which kindergarteners received instruction in number work, writing skills, visual discrimination, letter recognition, and colors. Many different structures and groupings of a class are possible within the learning-center format, and the teacher can spend her time in various ways. The general problem faced in devising a successful learning-center format is that of finding the optimal arrangement of structure and teacher time in order to elicit the greatest academic achievement.

The problem considered in the present experiment focused on effective use of teacher time. With 28 students working at small tables on individually programmed materials, a teacher can use her instructional time in two different ways. She can either work with one small group at a time, while the remaining children are working independently; or, she can move from table to table giving assistance to individual children as needed. The question of interest here was whether one of the two methods would give the teacher more opportunity to provide academic input, or whether there would be no difference between the methods in this regard. More specifically, the study investigated whether a teacher, working with a small group of six children over five continuous minutes, would give more units of academic statements than if she was monitoring 22 children for 20 minutes, giving individual help as she saw fit.

Method

Subjects

The student subjects were 28 kindergarten children at KEEP. They were divided into five academically heterogeneous groups; each group was given a color name for identification (i.e. green, orange, blue, red, and yellow). The groups were essentially equal, none containing a disproportionate number of either exceptionally bright or disruptive children. The six Ss in the "green" group were assigned to condition A, while the remaining groups were assigned to condition B, in which the teacher monitored all 2 children at once.

The teachers in the experiment were the four teachers of the KEEP staff, all of whom had previously handled the learning-centers and were familiar with the children. The teachers were similar in that all had some background in elementary teaching, but differed greatly in amount of teaching experience.

Setting

Learning-centers were conducted from approximately 8:25 a.m., or as soon as morning routines were finished, to 9:15 a.m. Within the classroom, there were five learning-centers, each consisting of a large table and six chairs, and supplies such as pencils, paste, scissors, and a box with individual work folders, containing assignments for each of the 28 children.

Each group was assigned to one center for a 25-minute period, so that they worked at two centers on any morning. The centers were given numerical names (1-writing skills, 2-visual discrimination, 3-number work, 4-colors, and 5-letter recognition), and the groups moved from center to center in numerical order. The orange group, for example, might go to centers 2 and 3

on Monday, centers 4 and 5 on Tuesday, centers 1 and 2 on Wednesday, and so on. One schedule for the rotation of groups from center to center was set up for the entire time period of the experiment.

Designation of Control Subjects

To compare the achievement of the children in the green group with the rest of the class, each child was matched with a control child for each center. The alternative method of matching each child in the green group with one child in the rest of the class was discarded because of the differences in achievement levels already present within the centers. Instead, at the beginning of the experiment, green group children were matched with other children of the same achievement level at each of the various centers. One exception to this practice was made in assigning the control children for achievement at center 2. Since the children started on a completely new series of objectives, the control group was matched to the green group by I.Q.

This manner of choosing control children was an unusual procedure because it meant, theoretically, that one child could have five different controls, one for each center. In fact, two children had four different controls, and four children had three different controls. The rest of the children had one or two matched controls.

Procedure

Under condition A, the experimental condition, the teacher stationed herself at the given center with the green group for a period of five minutes. During this time, she watched the group closely, attempted to reinforce appropriate behavior of individuals within the group, and provided as much academic input as possible. The teacher still kept an eye on the rest of the class, but she concentrated as much as possible on the designated

group. The other students had been instructed beforehand to wait for the teacher to help them rather than to approach her for help.

Under condition B, the teacher continued to run the learning-centers as she had done previously, except that she ignored the green group. She walked around the room scanning the large group, reinforced appropriate behavior, and provided academic input.

Each of the four teachers ran the centers for five consecutive school days. Center time was divided into two periods of 25 minutes each. Each 25-minute period was split into five 5-minute segments, with one of the 5-minute segments scheduled for condition A. During the remaining 20 minutes, the teacher conducted the class under condition B procedures. The 5-minute period during which the teacher instructed the green group only, was randomly assigned to one of the five 5-minute time slots within a learning-center period. That is, condition A could occur during the first, second, third, fourth, or final five minutes of the 25-minute period.

Data Collection

Data were collected on two dependent variables: 1) amount of teacher academic input, and 2) academic achievement of the children.

Teacher academic input. The teacher's verbalizations were tape recorded. A transcript was made and a count of input units was then taken from the transcript.

A teacher verbalization was counted as a unit of academic input if it involved one of the following:

1. Explanation given to a child, including instruction and modeling;
2. Correction of a child's work responses (specifying what he is doing wrong);

3. Reemphasis or reminder, reiterating directions previously given;
4. Directed question;
5. Answer to a child's question;
6. Direction, not including procedural directions;
7. Praise for a correct academic response by a child, when the proper behavior has been specified;
8. Checking a child's work.

Reliability of scoring for the teacher input category was established at 90 percent by comparing agreements and disagreements of two independent observers.

A transcript was made each day for one of the two learning-center periods of the 5 minutes of condition A and a randomly selected 5 minutes of condition B. The teachers were not informed which period would be selected for transcription.

Academic achievement of the students. Two basic measures of achievement were used: 1) number of pages of work completed by a child at a given center (a measure of effort), and 2) number of pages completed correctly (a measure of academic achievement). Assignment at the five centers varied considerably in difficulty and time required for completion and, therefore, number of pages completed at one center was not necessarily comparable to the number of pages completed at another center.

Results

The number of units of academic input delivered under condition A and under condition B over her 5 days of teaching were compared for each teacher (see Table 1). Only for Teacher 4 were the number of units reliably higher under one of the conditions, namely under condition B (t=11.27, $p < .01$).

However, when the number of academic input statements are averaged for each teacher in each condition, and the mean number of statements given in each condition are analyzed for the teachers as a group, there are significantly more units of academic input given under condition B. than under condition A (t=4.54, $p < .02$).

Table 1

Mean Number of Teacher Academic Inputs

in Experimental and Control Conditions

Teacher	Experimental (Green A Group)	Matched Controls (Other - B Group)
1	25.6 (N=5)	30.2 (N=5)
2	39.3 (N=4)	41.8 (N=4)
3	35.0 (N=5)	41.8 (N=4)
4	26.5 (N=5)	34.5 (N=4)

Academic Achievement

Table 2 shows the achievement of the green group children and their controls by center. The figures shown represent average number of pages completed and correct per day, when averages for all six children are summed. The figures give an idea of how many pages the whole group might be expected to complete on the average at each center in a single session. In terms of both pages correct and pages completed, it can be seen that the experimental group children ranked slightly ahead of the controls at centers 1, 2, and 5. However, there was no significant difference in achievement between the experimental group children and their controls at any center. When achievement at all five centers is considered, the difference between the two groups is not significant.

Table 2

Mean Number of Completed and Correct Pages for Experimental and Control Groups by Centers

	Center 1		Center 2		Center 3		Center 4		Center 5	
	cor	comp	cor	comp	cor	comp	cor	comp	cor	comp
Experimental Group	37.2	41.6	21.8	25.9	14.6	21.4	7.3	7.4	8.1	9.0
Matched Controls	36.3	39.8	20.6	24.3	14.9	21.6	7.6	7.6	6.6	6.6

Comparison of Green Group Achievement Under High Input and Low Input Teachers

Further data analysis was carried out to determine if there was any relationship between teachers who gave high and low input, and achievement of the green group (condition A). Teacher 2 had the greatest input with an average of 39.3 statements of input to the experimental group children per 5-minute time period, while Teacher 1, on the average, made only 25.6 statements during the same length of time (see Table 1). The difference between the two teachers' rate of input is significant to the .05 level.

However, there was no great difference in green group achievement. While the differences are not statistically significant, some differences in the means for both pages correct and pages completed were found. In both cases, the means are higher under Teacher 1, the low input teacher, than under Teacher 2, contrary to the expectation that teacher input and student achievement would be positively correlated.

Discussion

The results indicate that all four teachers made more statements of academic input to students under condition B than under condition A. Thus, a teacher who is monitoring a large group of children in learning-centers is

likely to give more statements of academic input to students than when she is monitoring a small group of children at a single learning-center. Apparently, with a large group of children, it is more likely at any given moment that one or more children will need help. With a small group of children being monitored for five minutes, the number of opportunites for a teacher to render assistance is restricted.

In the learning-center situation, it would seem that teacher time can best be spent monitoring the large group, and giving assistance as needed by the children. This strategy would be in contrast to one in which the teacher follows a fixed schedule, spending a set period of time each day working with small groups at different learning-centers.

However, the data make it questionable whether large group monitoring is actually preferable. Differences in achievement between condition A and B were not statistically significant, yet children under the former condition did do better. This trend, although slight, is surprising in light of the fact that the teachers made fewer academic statements under condition A. When academic achievement is compared within the green group, a similar trend is found. The children perform somewhat higher under the lower input situation. These findings indicate that absolute number of academic instruction units is not necessarily related to students' academic achievement.

Possibly, differences in achievement between the large and the small group conditions might have been more pronounced had there been more specification of the teachers' role in condition B. While the procedure to be followed for condition A was spelled out, the procedure for condition B was left largely to the teachers' own judgment. Observations suggested that the teachers sometimes acted in condition B as they did in condition A.

While they were supposed to be monitoring the large group, they tended to station themselves at one center, spending four or five minutes with the small group of children working there.

Future Directions

The results of this study indicate many areas of research in effective teacher strategies in learning-centers. Foremost among these should be a closer and more thorough examination of teacher statements of academic input, as can be seen from the achievement under condition A, which was equal to that under condition B despite significantly less frequent teacher input. Some of the subcategories of input, such as giving directions, praising, or explaining, should be elaborated and reliably coded in the future.

Teacher use of "voice control" when children are in learning-centers could also be explored. An example of good voice control might occur when a teacher makes statements to one child which are intended for the benefit of the whole group, as well. This type of input seems to be a practical compromise between giving individual attention and maintaining control of the group.

Various methods of checking children's work systematically and immediately in the learning-centers, might also be the subject of future experiments. A real problem, which often arises in learning-centers, is that the teacher feels that she lacks information about how students are spending their time, and what they are learning. Children may experience similar feelings because they do not get enough immediate feedback about their work. A sense of "closure" is important for both children and teacher, and is effected by daily checks of a child's work.